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16-720 Computer Vision  
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## 3D Scene Reconstruction from Single Moving Camera

### 1 Project Overview

3D scene reconstruction is useful in robotics for understanding a robot's environment can aid in navigation through this environment. One typical approach is to use a combination of a GPS, laser scanners, and inertial measurement units to generate a map of the environment. However, this requires extensive, expensive, and specialized hardware. We would like to reconstruct a scene using video recorded from a standard monocular camera.

The goal of this project is to reconstruct a 3D scene using video recorded from a standard cell phone camera. This project will attempt to recreate the work of Newcombe and Davison ([8]). They present an algorithm that efficiently generates a dense model of a camera scene. It leverages a structure from motion algorithm called "Parallel Tracking and Mapping" (PTAM) to extract a high density of keypoints from each frame of the video feed. Their algorithm uses these points to first construct a low resolution model of the environment. Using groups of camera views with overlapping surface visibility, the model coarse model is refined to yield a dense depth map. Once this depth map is created for various scenes in the environment, the individual depth maps are stitched together to create a 3D map of the entire environment.

SFM is a relatively mature topic of study within computer vision, and, as such, there are a breadth of resources to draw from in pursuit of this project objective. Other papers that address similar problems and which we may refer to include [8], [1], [4], [9], [5], [6], [3], [7], and [2].

### 2 Timeline

How much time do have for this? The online calendar isn't clear...

Are we expected to start working on the project after HW5 is due or before? If after, we have like no time to work on this.

## References

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